EQOBRUSH

POWERED BY **WACON**

AUTOMATIC CLEANING SYSTEM FOR CONDENSERS AND TUBE HEAT EXCHANGERS
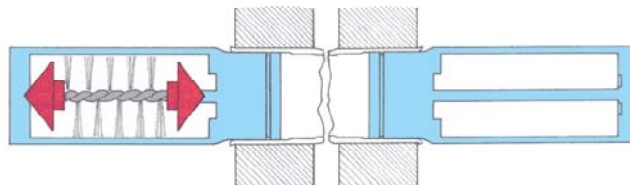
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Introduction

The formation of deposits and other contamination is a serious problem for branches of industry in which heat exchangers play an important part. First a loose, gelatinous amorphous deposit will form, which tends to harden on the surfaces being heated. This will often result in pitting provoked by local deposits forming galvanic cells.

To remedy this situation, various means and processes are employed. In their essential features they can be classified as intermittent and continuous. Acid treatment and mechanical cleaning, e.g., are intermittent processes. True, very effective but, in principle, they require the functioning of the heat exchanger to be interrupted. Moreover, between the relevant cleaning operations a period of reduced heat transfer efficiency has to be considered.

The continuous process include the processing of cooling water by the constant addition of chemicals, in order that the formation or adherence of abrasive materials as well as the application of sponge balls are among the methods gaining more and more ground in the last few years. The automatic WACON-KALVO brush cleaning system offers the following effective advantages as compared with the other well-known processes:

- The cleaning effect is the result of a physical flow phenomenon, without the necessity of laying the exchanger out of service.
- Constrained cleaning of each individual tube is guaranteed at any desired moment.
- Any accident whatever is ruled out. So it cannot possibly occur that pipes or individual parts thereof are only cleaned seldom, or not at all, which has also proved to be extremely advantageous in view of corrosion due to deposits of dirt or other substances contained in the water.
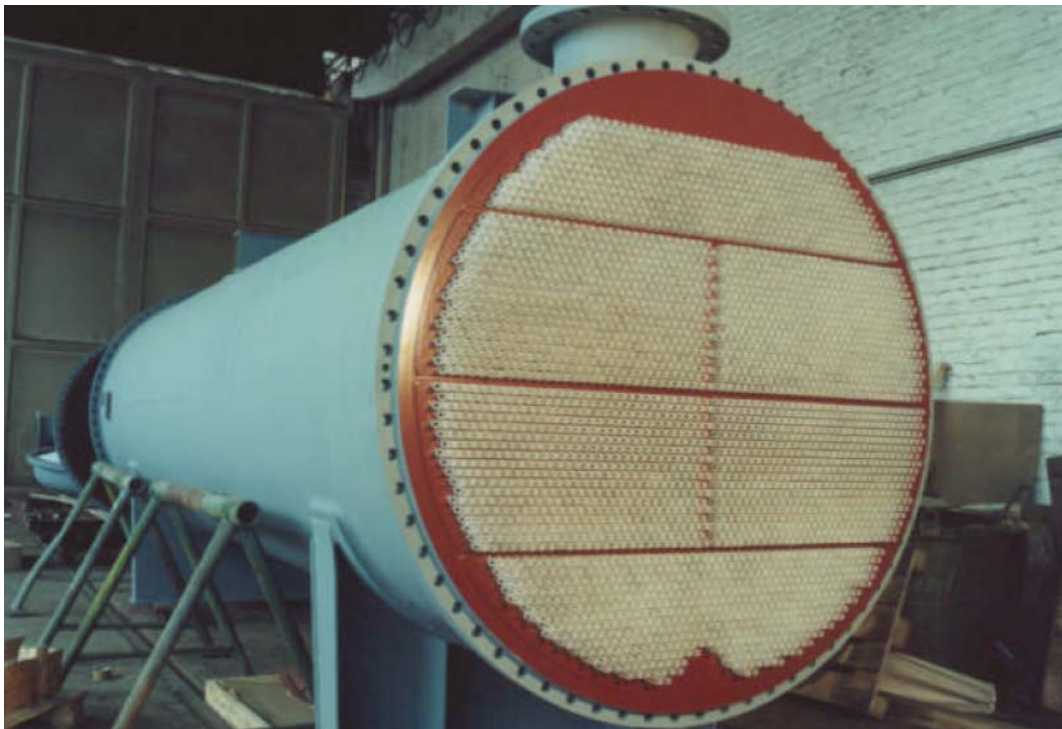
Description

The brush cleaning system consists of two catch baskets and one brush for each heat exchanger tube. Both baskets are permanently fitted to the pipe ends and serve to accept the brushes.

By reversing the direction of the cooling water flow, the brush is pressed through the tube and at the other end it is accepted by the basket. When the cooling water stream is diverted again in the normal direction, also the brush will return into the catch basket located at the delivery end, the inner walls of the tubes thus being cleaned now.

The reversal of the water flow direction occurs by means of a reversing armature which can be set to any desired cycle via an electric actuator and control box. This cleaning interval is fixed by our engineers according to the operating conditions and degree of contamination of the cooling medium, but dependent on seasons or other influences it may also be changed by the operating personnel.

The cleaning action of the brush makes it possible to remove loose, gelatinous deposits from the internal surface of the tube without any restriction and hard deposits, tending to adhere more strongly, cannot even get the opportunity to form. Moreover, sludge accumulations or other contamination are precluded.

Cleaning brushes

The assortment of cleaning brushes is designed for a diameter range from 10mm to 24mm in case of circular tubes, for elliptic tubes there is a special design available.

The cleaning function within circular tubes requires a **water flow velocity in minimum of 0.6 m/s** at a pressure drop of 0.06 bar**.** For elliptic tubes the velocity in minimum must be 1.0 m/s.

The friction resistance between bristles and the internal wall of the tube reduces the brush velocity to half of the water velocity. This velocity difference between cooling water flow and brush affects the splash-out of the soluble fouling particles. Any grinding on the natural protection layer of the heat transfer surfaces or protective layers provided are excluded.

The materials of brush caps, bristles and internal wire are resistant against any kind of cooling water (for example: city, ground, surface and sea water) up to water temperatures of 100°C. Special materials for hire temperature are also available.

The **live time of cleaning brushes** and accessories in standard design conditions and for regular cleaning periods from 4 to 6 hours amounts **5 years**.

Catch Baskets

The set of catch baskets includes many sizes to meet all tube diameters according to the metric and British dimensioning systems. In general, the connection will be executed by laminating with a special adhesive resulting in a save adhesion at the tube end for many years. But an absolute clean and grease free contact surface in the range of the sockets mouthpiece will be essential.

Another possibility of the connection is the shrinking method, If the tubes have an excess length in minimum of 10 mm.

The required free space for the different tube diameters and their spacing essential, please find out from our data sheets (download section).

The releasable connection between mouthpiece and basket enables very simple to exchange the brushes and/or their inspection, if required.

The catch baskets are no subject of wear and tear.

Reversing Armature

The most important component of the automatic brush cleaning system is the special reversing valve, designed as 4wayvalve in the nominal size from 80 mm to 600 mm, respective for nominal flow rate from 50m³/h to 3000 m³/h. In case of larger nominal sizes or flow rates, the flow direction will be reserved by butterfly valves. This method is approved in the power industry for many years.

Beside the functional security of long term operation the pressure drop and the leakage rate of the reversing armature are very important parameters. In our type DX they perform extreme low values.

The standard unit is designed for an operation pressure of 10 bar and a cooling water temperature in maximum of 50°C. In accordance with the actual operation conditions and water quality the units will be manufactured of construction steel inclusive coating (standard design) or of stainless steel.

The flow direction and the position of installation are variable, they will be arranged according to the local conditions.

Switch board

The switch board carries the components required for the automatic operation. Any time wanted between 15 minutes (min.) and 24 h (max.) can be switched on for the cleaning cycle by a special timer. For the remaining time in reverse position only 3 min. will be provided. All switching positions are affixed according to the actual operation conditions before delivery at site.

Between the cleaning periods, furthermore before start of operation or plan stop there are additional switches/cleanings possible by use a pressure switch. For function control each cycle will be registered by a counting device. In any case, if the torque switch of the actuator starts the alarm, the drive system returns to the final position before. The automatic operation remains in the breakdown position up to the time the pressure switch will be manually reset.

auma norm
SA 07.1 – SA 16.1

auma
GS 50.3 – GS 125.3
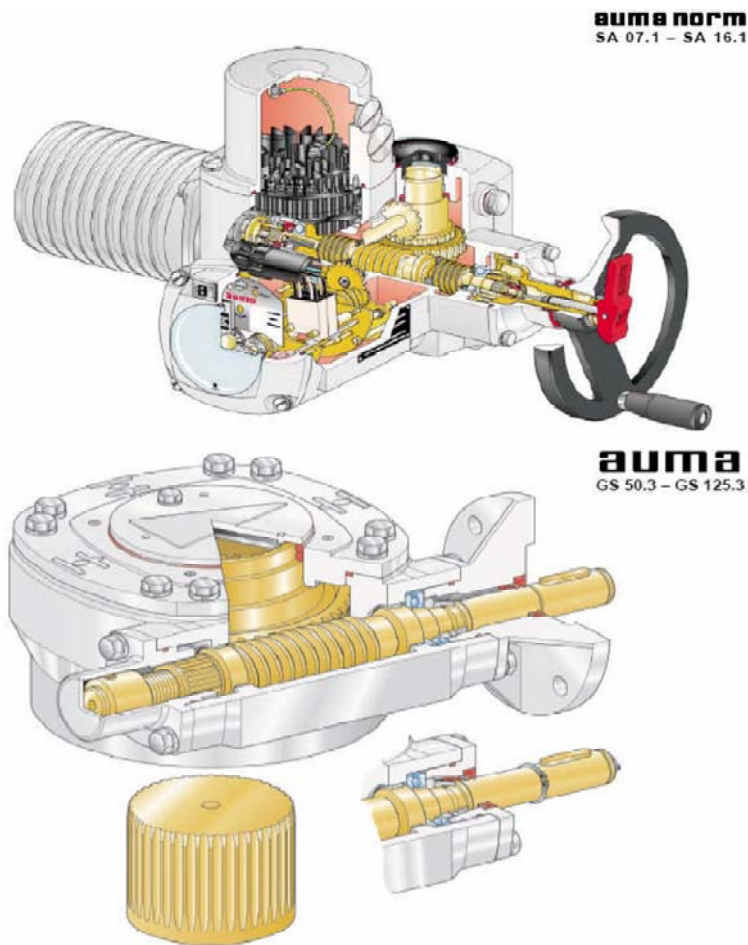
Electric actuator

The combination of rotating drive system and the worm gear unit was a success of our special reversing valve. It offers the selection of moving periods and moving forces for all armature sizes and operation conditions in optimum.

The electric motor drives via worm gear the shaft of the valve. Just in time, after arrival of the switched end position the rotating will be stopped by the limit switch. After the end of the remaining time defined in the reverse position it follows the way back to the normal flow automatically.

System Advantages

The benefits of the EQOBRUSH system have been most widely demonstrated by

the huge number of worldwide application in HVAC and industrial applications.

- Reduction in Energy consumption
  EQOBRUSH eliminates fouling and scaling and allows reduction of electrical <u>energy</u>
  <u>consumption is reduced by up to 30%.</u> The heat exchanger tubes are always optimally clean.
  The amount of debris build-up, or fouling on a tube is measured by the thermal resistance
  across the wall of a tube. This thermal resistance is expressed as the Fouling Factor.
  Examples of the amount of scale build-up, and the increase in power consumption for various
  fouling factors is illustrated in the Fouling Factor table below. EQOBRUSH Systems
  have consistently delivered fouling
  factors of 0.0001 to 0.0002 and have never exceeded .0005

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Examples of the amount of scale build-up, and the increase in power consumption for various fouling factors is illustrated in the Fouling Factor Table.

Fouling Factor FF	Scale thickness in mm	Power increase required
0.000	0.000	0.00%
0.0001	0.03	1.10%
0.0005	0.15	5.50%
0.0010	0.30	11.0%
0.0020	0.61	22.0%
0.0030	0.91	33.0%
0.0040	1.22	44.0%

- Reduction in Maintenance Costs
  - Down-time: periodical system shut-down for maintenance of chillers is eliminated
    by EQOBRUSH.
  - Reduction of the costs of labor, cleaning chemicals and cleaning
    equipment,

- <u>Human exposure to corrosive cleaning chemicals is eliminated.</u>

- Increase of Production Capacity
  If the heat exchanger performance is controlling the production output of your process, you benefit 24 hours a day, 365 days a year of your maximum production capacity.

- Reduction in Chemicals

  The amount of chemicals added to prevent scaling can often be reduced because the

  EQOBRUSH System keeps precipitates from forming on tube walls. Cleaning chemicals such

  as acids are not required anymore.

- Saving Water
  The EQOBRUSH System normally allows a higher cycle of concentration of the cooling water. This reduces the blow down volume and implies savings in water and sewer costs

Brush cleaning vs Ball Cleaning Systems:

Ball cleaning systems where sponge balls are injected into the cooling water stream and filtered out after the heat exchanger, do not warrant each tube to be cleaned. Only the tubes with higher water volumes are more likely to be cleaned. Tubes outside the midstream of the water are most likely never cleaned. With the EQOBRUSH system ALL the heat exchanger tubes are cleaned.

The complexity and investment levels for ball cleaning systems allow shorter payback periods for brush cleaning systems.

GERMAN TECHNOLOGY

The ECONOMIZER On-Load-Brush-Cleaning-System was developed by MAN Turbinenbau AG Nürnberg / Germany.

Worldwide patents are implicated. Nowadays the EQOBRUSH System is used in all continents.

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